

U.S. FISH AND WILDLIFE SERVICE SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

Scientific Name:

Ranunculus mauiensis

Common Name:

makou

Lead region:

Region 1 (Pacific Region)

Information current as of:

06/19/2014

Status/Action

☐ Funding provided for a proposed rule. Assessment not updated.

☐ Species Assessment - determined species did not meet the definition of the endangered or threatened under the Act and, therefore, was not elevated to the Candidate status.

☐ New Candidate

☒ Continuing Candidate

☐ Candidate Removal

☐ Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status

☐ Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species

☐ Range is no longer a U.S. territory

☐ Insufficient information exists on biological vulnerability and threats to support listing

☐ Taxon mistakenly included in past notice of review

☐ Taxon does not meet the definition of "species"

☐ Taxon believed to be extinct

☐ Conservation efforts have removed or reduced threats

___ More abundant than believed, diminished threats, or threats eliminated.

Petition Information

___ Non-Petitioned

X Petitioned - Date petition received: 05/11/2004

90-Day Positive:05/11/2005

12 Month Positive:05/11/2005

Did the Petition request a reclassification? **No**

For Petitioned Candidate species:

Is the listing warranted(if yes, see summary threats below) **Yes**

To Date, has publication of the proposal to list been precluded by other higher priority listing?
Yes

Explanation of why precluded:

We find that the immediate issuance of a proposed rule and timely promulgation of a final rule for this species has been, for the preceding 12 months, and continues to be, precluded by higher priority listing actions (including candidate species with lower LPNs). During the past 12 months, almost our entire national listing budget has been consumed by work on various listing actions to comply with court orders and court-approved settlement agreements, emergency listings, and essential litigation-related, administrative, and program management functions.

Historical States/Territories/Countries of Occurrence:

- **States/US Territories:** Hawaii
- **US Counties:** Hawaii, HI, Honolulu, HI, Kauai, HI, Maui, HI
- **Countries:** United States

Current States/Counties/Territories/Countries of Occurrence:

- **States/US Territories:** Hawaii
- **US Counties:** Hawaii, HI, Honolulu, HI, Kauai, HI, Maui, HI
- **Countries:** United States

Land Ownership:

Ranunculus mauiensis occurs on State and private lands. On Maui, 90 percent of the plants are on private lands and 10 percent are on State and private lands. On Kauai, all populations occur on State land. Two plants occur on private land on the island of Molokai.

Lead Region Contact:

ARD-ECOL SVCS, Jesse D'Elia, 5032312349, jesse_delia@fws.gov

Lead Field Office Contact:

PACIFIC ISLANDS FISH AND WILDL OFC, Kristi Young, 808-792-9419, kristi_young@fws.gov

Biological Information

Species Description:

Ranunculus mauiensis is an erect to weakly ascending perennial herb 20 to 79 inches (in) (50 to 200 centimeters) tall with fibrous roots. Stems are sparsely to densely pubescent with scattered whitish hairs. Basal leaves are compound with ovate leaflets with the terminal leaflet being the largest and irregularly serrate. Flowers are few, in branched loose cymes. Petals are yellow and glossy on the upper surface. Achenes are numerous in a globose head and have smooth faces (Wagner et al. 1999).

Taxonomy:

Ranunculus mauiensis was described by Asa Gray (1854). This species is recognized as a distinct taxon in Wagner et al. (1999, p. 1,089), the most recently accepted Hawaiian plant taxonomy.

Habitat/Life History:

There is limited information available on the habitat and life history of this species. Typical habitat is open sites in mesic to wet forest and along streams at elevations around 3,500 to 5,600 feet (ft) (1,060 to 1,710 meters (m)) (Wagner et al. 1999, p. 1,089).

Historical Range/Distribution:

Historically, *Ranunculus mauiensis* was known from five islands. On the island of Hawaii it was found at Kealahou. On Kauai, *R. mauiensis* occurred at Kuia, Kokee, and Na Pali Kona. On west Maui this species was known from Puu Kukui, Kapunakea, and Pohakea; and on east Maui it could be found at Olinda, Kipahulu, Waikamoi, and Puu Alaea. On Molokai, it occurred at Kamakou, Kalae, Waikolu, and Kaluaaha Valley; and on Oahu, *R. mauiensis* was known from the Waianae Mountains (HBMP 2008).

Current Range Distribution:

Currently *Ranunculus mauiensis* is known from three islands, Kauai (Kokee State Park and Na Pali Kona); Maui, both east (Waikamoi Preserve, Makawao Forest Reserve, and Manawainui) and west (Kapunakea Preserve, West Maui Forest Reserve, and West Maui Natural Area Reserve); and Molokai (Kamakou Preserve) (Wood, in litt. 2007; HBMP 2008; Oppenheimer, in litt. 2008).

Population Estimates/Status:

Ranunculus mauiensis is currently known from 14 populations on Maui, Molokai, and Kauai observed during surveys conducted as recently as 2007. (Wood, in litt. 2007; Perlman, in litt. 2007; Oppenheimer, in litt. 2008; HBMP 2008), totaling 198 individuals. We are unaware of additional surveys conducted to date. Nine populations are known from the island of Maui. Five populations occur on west Maui (one population at Kapunakea Preserve of 5 individuals, one population of 5 individual at Pohakea gulch, one population of 5 individuals at Lihau, one population of 1 individual at Kauaula Valley, and one population of 34 individuals at Puehuehunui); and four populations of approximately 90 plants are found on east Maui (20 individuals at Waikamoi Preserve, 30 individuals at Makawao Forest Reserve, one population of 10 individuals within Kahikinui, and 10 individuals at Manawainui (Nakula Natural Area Reserve also within Kahikinui))

(Perlman, in litt. 2007; Wood, in litt. 2007; Bily 2007, pers. comm.; Plant Extinction Prevention Program (PEPP), in litt. 2011). Five populations occur on the island of Kauai: Kalalau-Honopu (34 individuals), Nualolo (12 individuals), Kawaiiki ridge (4 individuals), Nawaimaka (1 individual), and Nawaimaka stream (2 individuals) (Perlman, in litt. 2007; Wood, in litt. 2007; HBMP 2008; PEPP, in litt. 2011). Two populations of one individual each were known to occur in Kamakou Preserve on Molokai (HBMP 2008); however, recent surveys have been unable to relocate these individuals (PEPP 2010, p. 105; Bakutis, in litt. 2011).

Threats

A. The present or threatened destruction, modification, or curtailment of its habitat or range:

Ranunculus mauiensis is highly and imminently threatened by feral pigs (*Sus scrofa*) and goats (*Capra hircus*) on Maui and Kauai; by introduced mule deer (*Odocoileus hemionus*) on Kauai and axis deer (*Axis axis*) on east Maui; and by feral pigs on Molokai (Moses, in litt. 2009). All four species are known to degrade and destroy habitat (HBMP 2008). Evidence of the activities of feral pigs, goats, and mule deer has been reported on the island of Kauai in areas where *R. mauiensis* is known to occur (Perlman, in litt. 2007), and evidence of feral pigs, goats, and axis deer has been reported from areas on Maui where populations of *R. mauiensis* are present (Bily 2007, pers. comm.; Wood, in litt. 2007).

Pigs of Asian ancestry were introduced to Hawaii by the Polynesians, and the Eurasian type was introduced to Hawaii by Captain James Cook in 1778, with many other introductions thereafter (Tomich 1986). Some pigs raised as food escaped into the forests of Hawaii, Kauai, Oahu, Molokai, Maui, and Niihau, and are now managed as a game animal by the State to optimize hunting opportunities (Tomich 1986; State of Hawaii 2001). In a study conducted in the 1980s on feral pig populations in the Kipahulu Valley on Maui, the deleterious effects of feral pig rooting on native forest ecosystems was documented (Diong 1982). Kipahulu Valley consists of a diverse composition of native ecosystems, from near sea level to alpine, and forest types ranging from mesic to wet, *Acacia koa* (koa) and *Metrosideros polymorpha* (ohia). Rooting by feral pigs was observed to be related to the search for earthworms, with rooting depths averaging 8 inches (20 centimeters) greatly disrupting the leaf litter and topsoil layers and contributing to erosion and changes in ground topography. The feeding habits of pigs were observed to create seed beds, enabling the establishment and spread of weedy species such as *Psidium cattleianum* (strawberry guava). The study concluded that all aspects of the food habits of pigs are damaging to the structure and function of the Hawaiian forest ecosystem (Diong 1982).

The goat, a species originally native to the Middle East and India, was successfully introduced to the Hawaiian Islands in 1792. Currently, populations exist on Kauai, Oahu, Maui, Molokai, and Hawaii. Goats browse on introduced grasses and native plants, trample roots and seedlings, cause erosion, and promote the invasion of alien plants. Goats are able to forage in extremely rugged terrain and have a high reproductive capacity (Clarke and Cuddihy 1980; van Riper and van Riper 1982; Scott et al. 1986; Tomich 1986; Culliney 1988; Cuddihy and Stone 1990). A study of goat predation on the native *A. koa* forest on the island of Hawaii has shown that grazing pressure by goats can cause the eventual extinction of *A. koa* because it is unable to reproduce (Spatz and Mueller-Dombois 1973). An enclosure analysis demonstrated that release from goat pressure by fencing resulted in an immediate recovery in height growth and numbers of vegetative resprouts of *A. koa* (Spatz and Mueller-Dombois 1973). Another study at Puuwaawaa on the island of Hawaii demonstrated that prior to management actions in 1985, regeneration of endemic shrubs and trees in the grazed area was almost totally lacking, contributing to the invasion of the forest understory by exotic grasses and weeds. After the removal of grazing animals in 1985, *A. koa* and *Metrosideros* spp. seedlings were observed germinating by the thousands (Department of Land and Natural Resources 2002).

Mule deer, native to western North America to central Mexico, were brought to Kauai from Oregon in the

1960s for game hunting. Mule deer were introduced, in part, to provide another animal for hunting, since the State had planned to reduce the number of goats on Kauai as they were so destructive to the landscape (Kramer 1971). During the mid-1980s, about 400 animals were known in and near Waimea Canyon, with some invasion into the Alakai Swamp in drier periods. Mule deer trample native vegetation and cause erosion by creating trails and removing vegetation (Hawaii Department of Land and Natural Resources 1985; Tomich 1986; Cuddihy and Stone 1990).

Axis deer were introduced to Maui in 1959, with five being released east of Kihei. By 1968, the Maui population was estimated to be 85 to 90 animals and currently there is concern that their numbers could expand to between 15,000 to 20,000 or more within a few years (Waring 1996; Nishibayashi, in litt. 2001; Anderson, in litt. 2001). Axis deer are primarily grazers, but also browse numerous plant species including those grown as commercial crops (Waring 1996; Simpson, in litt. 2001).

Hawaiian ecosystems, having evolved without hoofed mammals, are susceptible to large-scale disturbance by pigs, goats, and other introduced ungulates (Loope et al. 1991). Because of demonstrated habitat modifications by feral pigs, goats, and deer, such as destruction of native plants, disruption of topsoil leading to erosion, and establishment and spread of nonnative plants; the U.S. Fish and Wildlife Service (FWS) believes they are all threats to *R. mauiensis*.

Climate change may pose a threat to the ecosystem that supports this species. Fortini *et al.* (2013, pp. 1134) conducted a landscape-based assessment of climate change vulnerability for native plants of Hawaii using high resolution climate change projections. Climate change vulnerability is defined as the relative inability of a species to display the possible responses necessary for persistence under climate change. The assessment by Fortini *et al.* (2013, p. 87) concluded that *Ranunculus mauiensis* is vulnerable to the impacts of climate change. Therefore, additional management actions may be needed to conserve this taxon into the future.

B. Overutilization for commercial, recreational, scientific, or educational purposes:

None known.

C. Disease or predation:

Predation by feral pigs and goats (Maui, Molokai, Kauai), and deer (mule deer on Kauai and axis deer on Maui), are potential threats to *Ranunculus mauiensis* at all locations where the species is present, except a small area within the Waikamoi Preserve where plants are protected in an enclosure (Wood, in litt. 2007; Bily 2007, pers. comm.). Browsing by ungulates has been observed on many native plant species, including common and rare or endangered species (Cuddihy and Stone 1990; Loope et al. 1991). Because Hawaii's native plants evolved without any browsing or grazing mammals present, many lost natural defenses to such impacts (Carlquist 1980).

Pigs are omnivorous in their diet. In the study described above on feral pig populations in the Kipahulu Valley, pigs were observed browsing on young shoots, leaves and fronds of a wide variety plants, of which over 85 percent were endemic species (Diong 1982). A stomach content analysis showed that the pigs food sources consisted of native plants, 60 percent of which was *Cibotium* spp. (tree ferns), alternating with *Psidium cattleianum* (strawberry guava) when it was available. Pigs were observed felling and removing the bark of *Clermontia*, *Cibotium*, *Coprosma*, *Psychotria*, and *Hedyotis* species (herbaceous and woody plants), and causing enough damage to kill larger trees over a few months of repeated feeding. Therefore, even though we have no evidence of direct browsing for *R. mauiensis*, predation by feral pigs they are potential threats to this species.

Predation and habitat degradation by goats is a potential threat especially on the island of Kauai where populations of *R. mauiensis* occur (Perlman, in litt. 2007).

Deer are primarily grazers, but also browse numerous plant species (Waring 1996). Therefore, even though there are no observations of browsing for this species, it is likely that both mule deer and axis deer impact this species directly as well as the surrounding habitat.

Nonnative slugs are generalist herbivores (Rathke 1985) that feed principally on plant seedlings and low-lying herbs, yet they are not completely indiscriminate in their choices of foods (Dirzo 1980; Joe 2006). While native Hawaiian plants have had to defend themselves against avian, insect and possibly snail herbivory, the defense mechanisms evolved by Hawaiian plants may not be very effective against nonnative slugs (Joe 2006). In the Kahanahaiki Management Unit on Oahu, nonnative slugs were found to be responsible for substantial seedling mortality of certain native plant species. Of three native species studied, two had significantly higher seedling mortality (50 percent) when exposed to slugs (Joe 2006). Slug damage has been observed on *R. mauiensis* in cultivation and in the wild (Medeiros 2007, pers. comm.). The effect of slugs on the decline of this and related species is unclear, although slugs may pose a threat by feeding on the stems and fruit, thereby reducing the vigor of the plants and limiting regeneration (Mehrhoff, in litt. 1994; Perlman, in litt. 1994). Currently, there is no effective control method for this threat.

D. The inadequacy of existing regulatory mechanisms:

Ranunculus mauiensis currently receives no protection under Hawaii's endangered species law (HRS, Sect. 195-D) or the Federal Endangered Species Act (16 U.S.C. §1531-1544).

Goats, pigs, and deer are managed in Hawaii as game animals, but many populate inaccessible areas where hunting is difficult, if not impossible, and therefore has little effect on their numbers (Hawaii Heritage Program 1990). Goat, deer, and pig hunting are allowed year-round, or during certain months, depending on the area (Hawaii Department of Land and Natural Resources 1999, 2003); however, public hunting does not adequately control this threat to *R. mauiensis*.

E. Other natural or manmade factors affecting its continued existence:

Ranunculus mauiensis is threatened by alien plant species that degrade and destroy habitat and outcompete native plants (HBMP 2008). The nonnative plants that are reported to be the greatest threats to *R. mauiensis* on the island of Maui are *Ageratina adenophora* (Maui pamakani), *Andropogon virginicus* (broomsedge), *Clidemia hirta* (Kosters curse), *Hedychium gardnerianum* (kahili ginger), *Holcus lantanus* (common velvetgrass), *Rubus argutus* (prickly Florida blackberry), *R. rosifolius* (thimbleberry), and *Tibouchina herbacea* (glorybush). Nonnative plants which pose the greatest threats to *R. mauiensis* on the island of Kauai are: *C. hirta*, *Erigeron karvinskianus* (daisy fleabane), *H. gardnerianum*, *Kalanchoe pinnata* (air plant), *Lantana camara* (lantana), *Lonicera japonica* (Japanese honeysuckle), *Passiflora tarminiana* (banana poka), *Psidium cattleianum*, *R. argutus*, and *R. rosifolius* (HBMP 2008). The nonnative plants reported to be the greatest threats to *R. mauiensis* on the island of Molokai are *C. hirta*, *Passiflora edulis* (passion fruit, lilikoi), *R. argutus*, and *T. herbacea* (Moses, in litt. 2009).

Ageratina adenophora is native to tropical America, and has naturalized in dry to wet forest on the islands of Oahu, Molokai, Lanai, and Maui (Wagner et al. 1999). *A. adenophora* is a shrub 3 to 5 ft (1 to 1.5 m) tall with trailing branches that root on contact with soil. It forms dense mats which prevent regeneration of native plants (Anderson et al. 1992; University of California 2006). It is considered a serious weed in agriculture, especially in rangeland, because it often replaces more desirable vegetation or native species, and is fatally toxic to horses and most livestock. The eupatorium gall fly, *Procecidochares utilis*, was introduced to Hawaii in 1944 for control of *A. adenophora*, and has been successful in suppression of most of the infestations (Bess and Haramoto 1959).

Andropogon virginicus is a perennial bunchgrass native to northeastern America, now naturalized on Kauai, Oahu, and Hawaii along roadsides and in disturbed dry to mesic forest and shrubland (O'Connor 1999). Natural enemies from the native habitats of this grass are known, but their introduction to Hawaii as

biocontrol agents may not be possible as this grass is closely related to the commercially grown sugarcane (*Saccharum officinarum* L.) (Smith 1985). Seeds are easily distributed by wind, clothing, vehicles, and feral animals (Smith 1989). *A. virginicus* may release allelopathic substances which dramatically decrease native plant reestablishment (Rice 1972).

Clidemia hirta is a noxious shrub first cultivated in Wahiawa, Oahu, before 1941. This pest plant forms a dense understory, shading out native plants and hindering their regeneration, and is considered a serious plant threat (Wagner et al. 1985; Smith 1989). The most promising biological control to date for *C. hirta* is the *Colleotrichum* fungus, *Gloesporioides* f. sp. *clidemiae*, released in 1986. Although there is no quantitative data available, it has an observable negative impact. Other agents tested were a moth (*Antiblemma acclinalis*), a leaf-feeding beetle (*Lius poseidon*), a fruit and flower-feeding insect (*Mompha trithalama*), and a terminal growth-feeding insect (*Liothrips urichi*), all with lesser control success than the fungus (Smith 1989).

Erigeron karvinskianus is native to the Neotropics from Mexico to Venezuela, Chile, and the Antilles. It was cultivated in Hawaii as early as 1911 on Oahu, and is now naturalized on all the main islands, in moderately wet areas from 984 to 4,265 ft (300 to 1,300 m) (Wagner et al. 1999). Seeds are dispersed by wind and water, stems layer, and broken roots can regrow. *E. karvinskianus* reproduces and spreads rapidly to form dense mats, and can grow in almost any open habitat, including watercourses. This species crowds out and displaces ground level plants (Weeds of Blue Mountains Bushland 2006). We are unaware of any control methods for this species beyond herbicide application (University of Hawaii 2013).

Hedychium gardnerianum is native to India (Nagata 1999). This showy ginger was introduced for ornamental purposes, and was first collected in 1954 at Hawaii Volcanoes National Park (Wester 1992). Kahili ginger grows over 3.3 ft (1 m) tall in open light environments, preferring a warm moist climate; however, it will readily grow in full shade beneath a forest canopy (Smith 1985). It forms vast, dense colonies, displacing other plant species, and reproduces by rhizomes. The conspicuous, fleshy, red seeds are dispersed by fruit-eating birds as well as man. Aircraft-based analysis has shown that *H. gardnerianum* reduces the amount of nitrogen in the *Metrosideros* forest canopy in Hawaii, a finding subsequently corroborated by ground based sampling (Asner and Vitousek 2005). It may also block stream edges, altering water flow (Global Invasive Species Database 2005a). *H. gardnerianum* can be controlled by herbicides, but biological control is considered the only practical approach for the long-term management of large infestations in native forests. The ability of the bacterium *Ralstonia* (= *Pseudomonas*) *solanacearum* to cause bacterial wilt in this species in the field, together with its lack of virulence in other ginger species, contributes to its potential as a biological control agent (Anderson and Gardner 1999; Anderson 2003).

Holcus lanatus, native to Europe, is naturalized in Hawaii and occurs on poor, moist soils. *H. lanatus* is an aggressive weed, growing rapidly from basal shoots or prolific seed, and therefore can become dominant if not controlled. It gradually forces other plants out, reducing species diversity. Allelopathy may also play a role in the dominance of *H. lanatus* over other grasses (Remison and Snaydon 1980). The most effective control measure is physical removal by hand-pulling or hoeing. No effective means of biocontrol have been found (TNC 2005).

Kalanchoe pinnata is an herb which is widely established in many tropical and subtropical areas. In Hawaii it has been naturalized since prior to 1871, and is abundant in low elevation disturbed areas on all the main islands except Niihau and Kahoolawe (Wagner et al. 1999). *K. pinnata* can reproduce vegetatively at indents along the leaf, usually after the leaf has broken off the plant and is lying on the ground, where a new plant can take root. *K. pinnata* can form dense stands that prevent reproduction of native species (Starr 2006). We are unaware of any control methods for this species beyond herbicide application (University of Hawaii 2013).

Lantana camara, brought to Hawaii as an ornamental plant, is an aggressive, thicket-forming shrub which is now found on all of the main islands in mesic forest, dry shrubland, and other dry, disturbed habitats (Wagner

et al. 1999). The most effective control agents are the lace bug *Teleonemia scrupulosa* Stal. (Tingidae); the chrysomelid beetles, *Octotoma scabripennis* Guerin-Meneville and *Uroplata girardi* Pic; and the moths, *Hypena strigata* F., *Neogalea sunia* (Guenée) (Noctuidae), and *Salbia haemorrhoidalis* Guenée (Pyralidae). While biological control of *L. camara* by most of the established insects appeared to have reached equilibrium by 1969, the overall impact has been a steady and considerable reduction in abundance of *L. camara*, particularly in drought-prone areas. Although *L. camara* is considered generally to be under partial to substantial control in drier areas, it still remains a pest in some other environments, such as national parks (Hawaii Department of Agriculture 2006).

Lonicera japonica, native to Asia, is an ornamental groundcover that is commonly planted in many areas of the world. In Hawaii, it occurs in mesic to wet areas from sea level to at least 4,000 ft (1220 m) (Motooka et al. 2002) and is escaping cultivation in cool, mesic to wet areas in Kokee State Park, Kauai, on Oahu, east Maui, and near Volcano and slopes of Hualalai, Hawaii (Wagner et al. 1999, Starr et al. 2002). It is also located on west Maui at about 800 ft (244 m) elevation, and is spreading vegetatively into the surrounding disturbed forest. It is commonly spread by birds, stems, or pieces of stems and can grow up and over small trees and shrubs, smothering them. There has been no formal biological control program for *L. japonica* (Starr et al. 2003; Pacific Island Ecosystems at Risk (PIER) 2006a).

Passiflora edulis is native to Brazil, and is cultivated for its fruit in Hawaii. It has escaped and naturalized in mesic forest and shrubland on all the main islands (Escobar 1999). It is a vigorous, climbing vine that clings by tendrils to almost any support and can grow 15 to 20 ft (4.6 to 6.1 m) per year once established. The aggressive vines can smother trees and shrubs. Each fruit has hundreds of seeds which are eaten and distributed by pigs (PIER 2006b). We are unaware of any control methods for this species beyond herbicide application (University of Hawaii 2013).

Passiflora mollissima, a vine native to South America, is widely cultivated for its fruit (Escobar 1999). First introduced to Hawaii in the 1920s, it is now a serious pest in mesic forest, where it overgrows and smothers the forest canopy. Seeds are readily dispersed by humans, birds, and feral pigs (La Rosa 1992). Fallen fruit encourage rooting and trampling by pigs (Diong 1982). Field releases of biocontrol insects have not been successful, but testing of fungi as biocontrol of this vine is ongoing (Gardner 2005).

Psidium cattleianum, a tree native to tropical America, is widely naturalized on all the main islands of Hawaii. Found in mesic to wet forests, *P. cattleianum* develops into dense stands in which few other plants can grow, displacing native vegetation. The fruit is eaten by pigs and birds, which then disperse the seeds throughout the forest (Smith 1985; Wagner et al. 1985). A scale insect, *Tectococcus ovatus*, has undergone 15 years of testing as a biological control agent, and there is a proposal to release this insect at Olaa Forest Reserve on the island of Hawaii (ScienceDaily 2008).

Rubus argutus is native to the central and eastern United States, and is a serious weed that naturalizes in a variety of disturbed habitats (Tunison 1991). It reproduces both vegetatively and by seed (Tunison 1991). *R. argutus* was introduced to Hawaii in the late 1800s and was quickly spread by birds (Wagner et al. 1999; Tunison 1991). This taxon grows via runners underground, and readily resprouts from them if above ground tissue is treated with herbicide (U.S. Army 2006). Biological controls were introduced (moths, sawfly, and beetle), but the damage to this nonnative species so far has been negligible (Nagata and Markin 1986).

Rubus rosifolius is native to Asia and is common in Hawaii in disturbed mesic to wet forest on all of the main islands. It is a sparse shrub, covered with prickles, and has edible red fruit. It invades the understory, forming dense thickets and outcompetes native plant species. It easily reproduces from roots left in the ground, and seeds are spread by feral animals and birds. There is no specific management information for *R. rosifolius*, but techniques used for the control of blackberry *Rubus fruticosus*, which is a related species, may be applicable (PIER 2006c; Global Invasive Species Database 2006b).

Tibouchina herbacea, a member of the Melastomataceae family, is native to southern Brazil, Uruguay, and

Paraguay. In Hawaii, it is naturalized and abundant in disturbed mesic to wet forest on the islands of Hawaii, Maui, and Lanai (Wagner et al. 1999). It forms dense thickets, crowding out all other plant species and inhibiting regeneration of native plants (TNC 2003). All members of this genus are legally declared noxious in the State of Hawaii (Hawaii Administrative Rules (HAR) Title 4, Subtitle 6, Chapter 68). Research is ongoing for biological controls of this species (Smith 1998; TNC 2003).

The original native flora of Hawaii consisted of about 1,400 species, nearly 90 percent of which were endemic. Of the current total native and naturalized Hawaiian flora of 1,817 taxa, 47 percent are introduced species, and nearly 100 of these species have become pests (Smith 1985; Wagner et al. 1999a). Confirmed personal observations (HBMP 2008) and several studies (Cuddihy and Stone 1990; Wood and Perlman 1997; Robichaux et al. 1998, p. 4) indicate nonnative plant species may outcompete native plants similar to *R. mauiensis*. Competition may be for space, light, water, or nutrients, or there may be a chemical produced that inhibits growth of other plants (Smith 1985; Cuddihy and Stone 1990). In addition, nonnative pest plants found in habitat similar to that of this species have been shown to make the habitat less suitable for native species (Smathers and Gardner 1978; Smith 1985; Loope and Medeiros 1992; Medeiros et al. 1992; Ellshoff et al. 1995; Meyer and Florence 1996; Medeiros et al. 1997; Loope et al. 2004). In particular, alien pest plant species degrade habitat by modifying availability of light, altering soil-water regimes, modifying nutrient cycling, or altering fire characteristics of native plant communities (Smith 1985; Cuddihy and Stone 1990; Vitousek et al. 1997). Currently, many widespread alien plant taxa cannot be completely eradicated, and are expected to continue dispersing into managed areas (Loope 1998; Smith 1985). Because of demonstrated habitat modification and resource competition by nonnative plant species in habitat similar to that of *R. mauiensis* the FWS believes nonnative plant species are a threat to this species.

Conservation Measures Planned or Implemented :

Individuals from the Waikamoi Preserve population are protected within an enclosure (Bily 2007, pers. comm.; Medeiros 2007, pers. comm.). The East Maui Mountain Watershed Partnership, a non-governmental, non-profit partnership composed of east Maui landowners and managers, received funding from the FWS between 2005 and 2006 to complete a border fence for a 100,000 acre (40,469 hectare) area to exclude feral ungulates and control nonnative plants (USFWS 2006). This area provides protection within the historic range of *Ranunculus mauiensis*. Two Molokai individuals are found within the Kamakou Preserve, managed by TNC. None of the populations on the island of Kauai are protected or managed (Wood, in litt. 2007). This species is represented in ex situ collections at the National Tropical Botanical Garden (NTBG); Lyon Arboretum Micropropagation Lab (6 plants from Pohakea, Maui); the Olinda Rare Plant Facility (11 plants) (NTBG 2008, p 13; Conry, in litt. 2012; Imoto, in litt. 2013).

Summary of Threats :

Based on our evaluation of habitat degradation and loss by feral pigs, goats, and deer and competition with nonnative plants, we conclude there is sufficient information to develop a proposed rule for this species due to the present and threatened destruction, modification, or curtailment of its habitat and range, and the displacement of individuals of *Ranunculus mauiensis* due to competition with nonnative plants for space, nutrients, water, and light. Predation by feral pigs, goats, deer, and slugs are all potential threats to *R. mauiensis*. We find that this species is warranted for listing throughout all its range, and, therefore, find that it is unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.

For species that are being removed from candidate status:

_____ Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing Decisions(PECE)?

Recommended Conservation Measures :

- Protect all individuals from feral pigs, goats, and deer by removing these species from areas where *R. mauiensis* populations exist and preventing reinvasion through the use of exclosures.
- Control alien plants through physical, mechanical, and biological control methods, as well as herbicides when necessary. Continue to conduct research into potential biocontrol species.
- Develop and implement control methods for slugs.
- Conduct/update field surveys at known locations and in suitable habitat.
- Reintroduce individuals into suitable habitat within historic range that is being managed for known threats to this species.
- Propagate and maintain genetic stock.

Priority Table

Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2
		Subspecies/Population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/Population	6
Moderate to Low	Imminent	Monotype genus	7
		Species	8
		Subspecies/Population	9
	Non-Imminent	Monotype genus	10
		Species	11
		Subspecies/Population	12

Rationale for Change in Listing Priority Number:

Magnitude:

This species is highly threatened by feral pigs, goats, and deer that degrade and destroy habitat, and by nonnative plants that outcompete and displace it. Likely threats to this species include predation by feral pigs, goats, deer, and slugs. Threats to the mesic to wet forest habitat of *Ranunculus mauiensis*, and to individuals of this species, occur throughout its range and are expected to continue or increase without their control or eradication. About 20 plants are currently protected from feral pigs, goats, and deer (Bily 2007, pers. comm.; Medeiros 2007, pers. comm.).

Imminence :

Habitat degradation by feral pigs, goats, and deer, and competition with nonnative plants are imminent threats because they are ongoing. Possible predation by pigs, goats, deer, and slugs are considered non-imminent.

 Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determination whether emergency listing is needed?

Emergency Listing Review

___No___ Is Emergency Listing Warranted?

The species does not appear to be appropriate for emergency listing at this time because the immediacy of the threats is not so great as to imperil a significant proportion of the taxon within the time frame of the routine listing process. In addition, the East Maui Mountain Watershed Partnership received funding from the FWS in 2005 through 2006 to complete a border fence for a 100,000-acre area within historic range of this species. If it becomes apparent that the routine listing process is not sufficient to prevent large losses that may result in this species' extinction, then the emergency rule process for this species will be initiated. We will continue to monitor the status of *Ranunculus mauiensis* as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures.

Description of Monitoring:

Much of the information on this form is based on the results of two meetings of 20 botanical experts held by the Center for Plant Conservation in December of 1995 and November 1996. We have incorporated additional information on this species from our files and the most recent supplement to the Manual of Flowering Plants of Hawaii (Wagner and Herbst 2003). In 2006, we contacted the species experts listed below, but received no new information on this taxon. New status information was provided in 2007 by Steve Perlman and Ken Wood, NTBG; Hank Oppenheimer, Plant Extinction Prevention Program (PEPP)-Maui Nui; Art Medeiros, U. S. Geological Survey-Biological Resources Discipline; and Pat Bily, TNC. In 2008, we received new information from Hank Oppenheimer. In 2009, we received new information from Wailana Moses, TNC, and NTBG. In 2010, we received no new information. In 2011, we contacted the species experts listed below and received new information from Wendy (McDowell) Kishida from PEPP-Kauai and Ane Bakutis from PEPP-Molokai. In 2012 and 2013, we received information from the State and incorporated it into this form.

List all experts contacted in 2011:

Name Date Affiliation

Agorastos, Nick 02/16/11 Division of Forestry and Wildlife, Hawaii
Bakutis, Ane 02/16/11 Plant Extinction Prevention Program, Molokai
Ball, Donna 02/16/11 U.S. FWS, Partners Program, Hawaii
Bily, Pat 02/16/11 The Nature Conservancy, Maui
Bio, Kealii 02/16/11 Plant Extinction Prevention Program, Hawaii
Caraway, Vickie 02/22/11 Hawaii Division of Forestry and Wildlife, Oahu
Ching, Susan 02/16/11 Plant Extinction Prevention Program, Oahu
Clark, Michelle 02/16/11 U.S. FWS, Partners Program, Kauai
Duvall, Fern 02/16/11 Hawaii Division of Forestry and Wildlife, Maui
Fay, Kerri 02/16/11 The Nature Conservancy, Maui
Garnett, Bill 02/16/11 National Park Service, Kalaupapa, Molokai
Haus, Bill 02/16/11 National Park Service, Haleakala NP, Maui
Higashino, Jennifer 02/16/11 U.S. FWS, Partners Program, Maui
Imada, Clyde 02/16/11 Bishop Museum, Botany Department
Kawelo, Kapua 02/16/11 U.S. Army, Environmental Division
McDowell, Wendy 02/16/11 Plant Extinction Prevention Program, Kauai
Medeiros, Arthur 02/16/11 U.S. Geological Survey-Biological Resources Discipline
Moses, Wailana 02/16/11 The Nature Conservancy, Molokai
Oppenheimer, Hank 02/16/11 Plant Extinction Prevention Program, Maui Nui
Perlman, Steve 02/16/11 National Tropical Botanical Garden
Perry, Lyman 02/16/11 Division of Forestry and Wildlife, Hawaii

Pratt, Linda 02/16/11 U.S. Geological Survey, Biological Resources Division
Starr, Forest 02/16/11 U.S. Geological Survey
Stevens, Bryon 02/16/11 DLNR Natural Area Reserves, Maui
Ward, Joe 02/22/11 Puu Kukui Watershed Preserve
Welton, Patti 02/16/11 National Park Service, Haleakala NP, Maui
Wysong, Michael 02/16/11 DLNR Natural Area Reserves, Kauai

The Hawaii Biodiversity and Mapping Program identified this species as critically imperiled (HBMP 2006). Based on the International Union for Conservation of Nature and Natural Resources Red List of Threatened Species, this species is recognized as Endangered (facing a very high risk of extinction in the wild) (Bruegmann and Caraway 2003). *Ranunculus mauiensis* is included in the list of species in Hawaii's 2005 Comprehensive Wildlife Conservation Strategy (Mitchell et al. 2005).

Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment:

Hawaii

Indicate which State(s) did not provide any information or comment:

none

State Coordination:

On February 20, 2013, we provided the Hawaii Division of Forestry and Wildlife with copies of our most recent candidate assessments for their review and comment. New information was received on April 12, 2013, and incorporated into this report. In addition, we are in frequent contact with State botanists and, PEPP, a multiagency (including State and Federal) organization operated by the University of Hawaii that functions to prevent extinction of Hawaii's rarest and most threatened plants. Therefore, we believe this assessment contains the most recent available information on *Rununculus mauiensis*.

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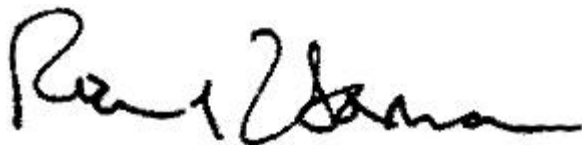
Simpson, J., Kula farmer, Deer population boom threatens Maui forests, farms, interview in the Honolulu Star-Bulletin by G.T. Kubota, August 28, 2001.

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Approval/Concurrence:

Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve:



06/18/2014

Date

Concur:



11/18/2014

Date

Did not concur:

Date

Director's Remarks: